A DISSERTATION ON

STUDY OF RECONSTRUCTION OF ACQUIRED AURICULAR DEFECTS

In partial fulfillment of the
regulations for the award of the degree of

MASTER OF CHIRURGIE

(M.Ch.,) Degree

BRANCH – III – PLASTIC SURGERY

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

CHENNAI – 600 032

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DECLARATION

I solemnly declare that this dissertation "**STUDY OF RECONSTRUCTION OF ACQUIRED AURICULAR DEFECTS"** was prepared by me under the guidance and supervision of Professor & HOD Department of Plastic and Reconstructive Surgery, Madurai Medical College and Government Rajaji Hospital, Madurai between 2007 and 2010.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfillment of the requirement for the award of MASTER OF CHIRURGIE, M.Ch., PLASTIC SURGERY, degree Examination to be held in AUGUST 2010.

Place: Madurai.

Date :

Dr. K. RAJA

CERTIFICATE

This is to certify that this dissertation entitled **"STUDY OF RECONSTRUCTION OF ACQUIRED AURICULAR DEFECTS"** submitted by **Dr. K.RAJA** Post Graduate, Department of Plastic and Reconstructive Surgery, Madurai Medical College to The Tamil Nadu Dr.M.G.R.Medical University, Chennai, in partial fulfilment of the requirement in the award of degree of **MASTER OF CHIRURGIE IN PLASTIC SURGERY, Branch – III,** for the August 2010 examination is a bonafide research work carried out by him under our direct supervision and guidance during the year 2007-2010.

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CONTENTS

INTRODUCTION

The human ear is a paradox. Conceptually simple it is a sandwitch, skin cartilage and skin, but in construct infinitely complex. Reconstruction of human ear is one of the greatest technical and aesthetic challenges, facing the plastic, reconstructive and aesthetic surgeon. The structure of ear has no ethnic or racial variation.

The three dimensional nature of the ear with many curls, peaks, and valleys makes this one of the most elegant body parts. The rigid nature of cartilage along with its elastic nature is a testament to its unique properties which makes it very difficult to reproduce.

Even minor deformities of pinna causes psychological distress. Some develop serious, behaviour problems and mood swings. Functional loss of pinna is a disability as ear supports glasses, head phones, bluetooth head sets.

Reconstruction of the ear can be a complex process. In certain cases staged reconstruction may be needed. Though reconstruction can be traced back to era of eighth century B.C. as recorded in Sushruta Samhita now even after advent of autologous tissue, alloplastic material, tissue engineering, tissue

expansion, prelaminated free flaps, ear reconstruction has been a great challenge.

It is difficult to match the flexibility of the ear while maintaining the rigidity and skin covering.

AIM OF STUDY

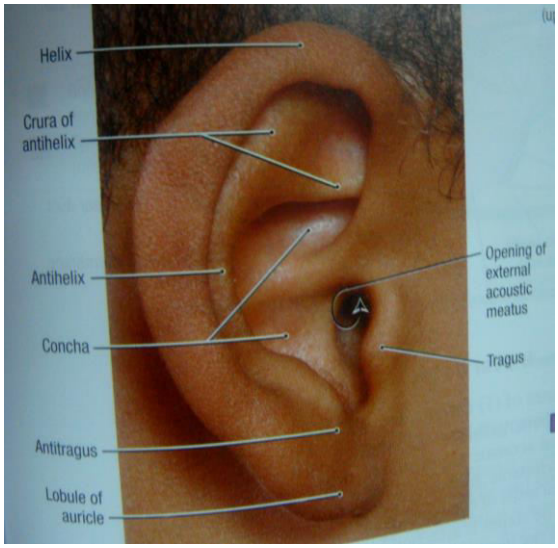
- To assess the various causes of acquired pinna defects.
- To study the age, sex distribution of the patients
- To evaluate results, outcome of various surgical procedures.
- To study the complications of various procedures.
- To evaluate the advantages of primary reconstruction over secondary reconstruction.

SURGICAL ANATOMY OF AURICLE

The external ear is composed of auricle or pinna, external auditary canal and lateral surface of tympanic membrane. The auricle is typically oriented at an anteroposterior rotational angle of 15-20°. The height corresponds to the height of the nose. The pinna is about 6cm from the lateral canthus and about 6-7 cm height from helical crus to lobule. The normal protrusion of pinna from the skull is about 25-30°.

The pinna is formed by a complexly convoluted frame of delicate elastic cartilage that is surrounded by fine skin envelope. The surface contours of the pinna corresponds to the convolution of the single elastic cartilage in upper two-thirds except for ear lobe which consists of fibrofatty tissue and not cartilage.

Parts of pinna



Helix forms the prominent auricular rim. Antihelix forms the prominence anterior to helix and has 2 crura superior and inferior. Triangular fossa is the space between the superior and inferior crura of antihelix. Scaphoid fossa is the space between helix and antihelix. Concha is a deep cavity posterior to external auditory meatus. The conchal cavity is divided into cymba concha superior to crus of helix and cavum concha inferior to crus of helix. Tragus is anterior to concha and partially covers the external auditory meatus. Antitragus is present posteroinferior to the tragus separated by intertragic notch. Lobule is present inferior to the antitragus. The pinna is attached to the temporal bone by fibrocartilaginous tissue.

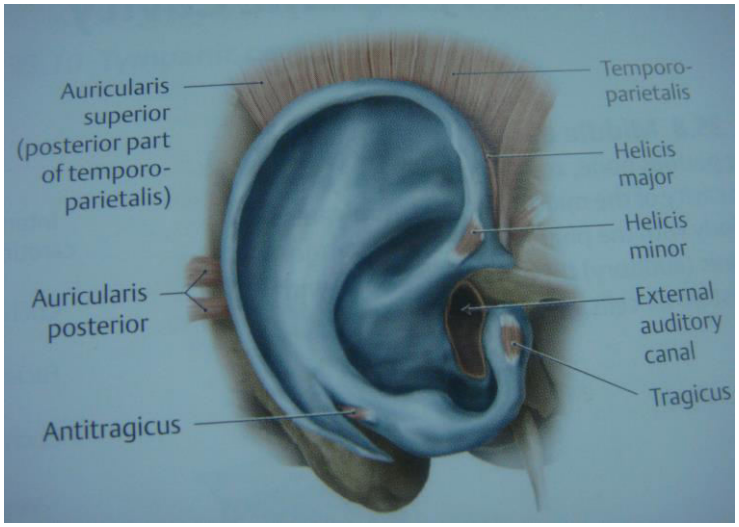
Skin

Skin of the pinna is thin with less subcutaneous tissue and adherent to the underlying cartilage. The posterior or medial surface of ear has more subcutaneous tissue more loosely attached to the framework.

Cartilage

The cartilage is closely adherent to the perichondrium and receives nourishment from overlying perichondrium. It is a single piece of elastic cartilage with curls and valleys. It is present in upper two third of pinna.

Muscle



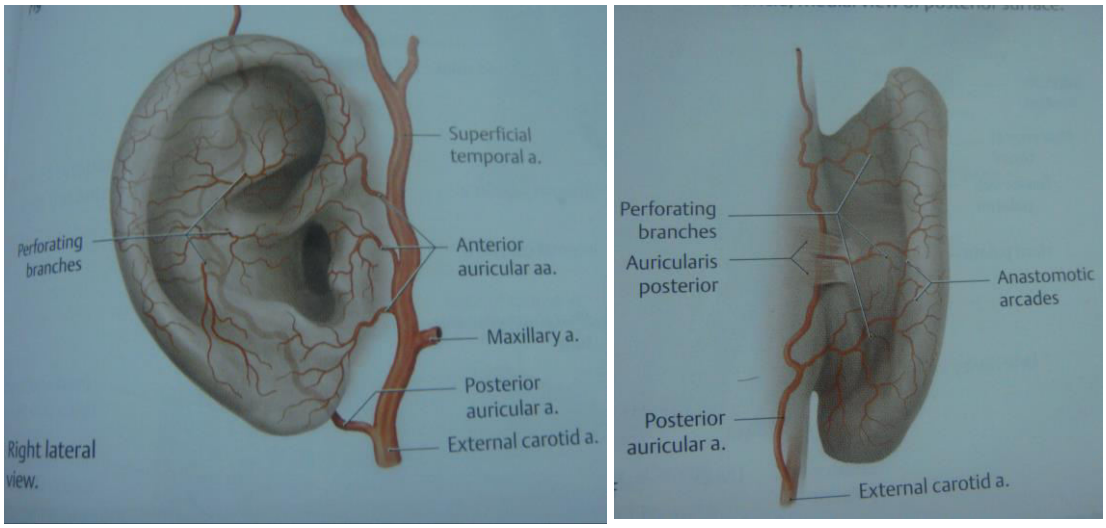
The auricle is connected to the scalp by 3 extrinsic muscles. They are anterior, superior and posterior auricular muscles. They have become vestigial and have no function.

The intrinsic muscles have both their attachments in the pinna itself. They are helicis major, helicis minor, tragicus, antitragicus, transverse auriculae, and oblique auriculae.

Ligaments

The anterior ligament extends from the tragus to the root of zygomatic process of the temporal bone. The posterior ligament passes from posterior surface of the concha to the lateral surface of the mastoid process.

Blood supply



Auricle is highly vascular and has intercommunication between

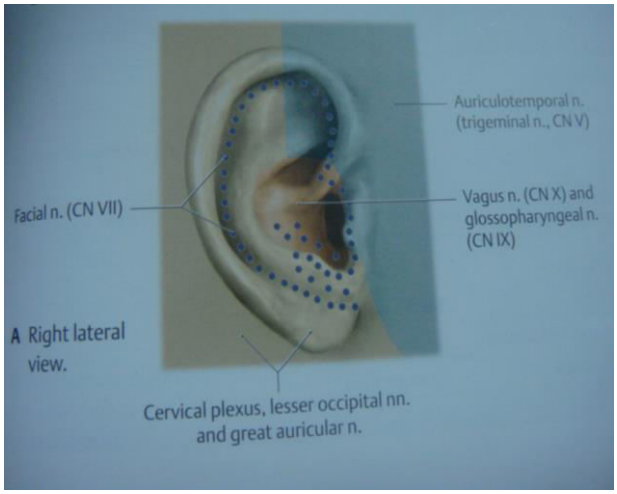
1. Posterior auricular artery
2. Superficial temporal artery
3. Occipital artery

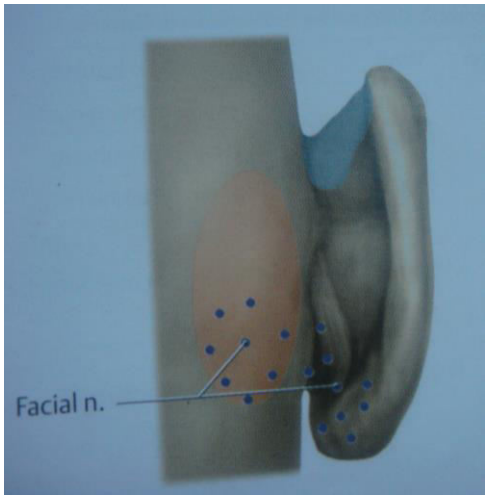
Venous drainage is by the corresponding veins.

Lymphatic drainage

Lymphatics from ear drain into preauricular, postauricular, parotid nodes and subsequently in upper deep cervical nodes in level II nodes.

Nerve supply





The **greater auricular nerve** supplies most of the auricle from posterior to anterior aspect of lobule, helix and antihelix. **The auriculotemporal nerve** is a branch of the mandibular division of trigeminal nerve and supplies tragus, helical crus, skin superior to auricle. **Lesser occipital nerve** supplies skin posterior to auricle. **Vagus nerve** supplies, posterior external auditory canal. **Facial nerve** supplies cavum concha.

REVIEW OF LITERATURE

Ear reconstruction is first referred in Indian ancient medicine text – The Sushruta Samhita where cheek flap was used for repair of ear lobule in 900 BC.

In 1597 Tagliacozzi an Italian has described repair of both upper and lower ear deformities with hairless pedicle retroauricular flaps. He has also described medial arm flap for auricular reconstruction. He also described using postauricular wedges to maintain ear projection.

In 1845 Diffenbach repaired middle third ear defect with an advancement flap and described the use of mastoid flap folded on itself.

In 1920 Gilles described use of carved costal cartilage buried under mastoid skin and separated it from head with cervical flap.

In 1930 Pierce modified Gilles technique by lining the new sulcus with a skin graft and building the helix with tubed flap from supraclavicular region.

In 1937 Gilles repaired more than 30 microtic ears with use of maternal ear cartilage. These were found to progressively resorb.

Steffensen used preserved rib cartilage to give excellent results but went for late resorption.

In 1940 Young and Peer conceived idea of framework prefabrication by implanting fenestrated two piece, ear shaped Vitalium mold filled with diced autologous costal cartilage in subcutaneous abdominal pocket.

After several months molds were retrieved and cartilage framework of cartilage chips were found united by connective tissue. But results were not consistent because of distortion due to contraction of fibrous tissue.

Cocheril cites many examples of successful replantation during 19th century. Cocheril cities memoirs of Stafford, in 1630-1640 during region of English king Charles I the victim's ear were nailed to wooden post and amputated. Prynne a lawyer one of the victims had his ear reimplanted but had signs of mutilation.

In 1957 Newman induced soft tissue growth with subcutaneously implanted balloon in an attempt, to reconstruct an external ear.

Later Radovan and Austad described tissue expansion by placing silicone balloons.

In 1958 Converse described the "tunnel procedure" for correcting upper and middle helical defects using a cartilage graft.

Crikelair described banner flap of supraauricular skin based on the auriculocephalic sulcus to reconstruct upper third auricular defects.

In 1959 Tanzer was successful in use of autologous costal cartilage which he carved as a solid block.

Brent and Nagata advanced ear construction with autologous costal cartilage graft in correction of congenital defects. Brent was first to report successful use of tissue expansion.

Cronin introduced silicon ear framework but like other inorganic implants they suffered high incidence of extrusion. Then MEDPOR framework were used but had problem as for any other implants.

Modern era of pinna reconstruction started with Tanzer's classic description of principles and technique of total ear reconstruction with autologous costal cartilage in congenital defect. But the principles hold good for acquired defects also.

Buncke in1966 reported first experimental microsurgical replantation.

In 1980 - Pennington et al performed the first successful clinical ear reimplantation.

Mladick et al and Curraway have advocated first dermabrasion and then reattachment of the amputated ear to stump.

Baudet removed the skin from the postauricular portion of amputated part fenestrated the cartilage and placed in retroauricular mastoid skin flap.

Prefabrication concept of Young and Peer is rekindled through modern "tissue engineering" technique in which cartilage cells are grown in laboratory on a synthetic biodegradable ear form.

Research have begun to explore possibilities of bioengineering firm autogenous cartilage framework and to see whether some limitations such as replicating sufficient chondrocytes from cartilage sample (25-50 million

cells/ml) needed for ear mold volume of 5 ml and ability of the chondrocytes to regenerate firm and elastic framework can be overcome.

Until tissue engineering evolves beyond the problems sculpted autogenous cartilage graft remain the most reliable material that produces results with least complications.

Recently Lanvers et al reported prelaminated flaps, by building cartilage frame work of ear on forearm and transferred by microsurgical technique have been used as an option of autologous reconstruction where other options are not available.

AETIOLOGY OF ACQUIRED AURICULAR DEFECTS

1. **Trauma**
    - Road traffic accident
    - Assault
    - Human / Animal bites
    - Gunshot injuries
2. **Infection**
3. **Tumour**
    - Benign
    - Malignant
4. **Burns**
    - Thermal
    - Electrical
    - Chemical
    - Radiation
5. **Others**

CLASSIFICATION OF ACQUIRED AURICULAR DEFECTS

I. Based on amount of loss

- Partial loss
- Total loss

II. Based on component loss

- Skin
- Cartilage
- Both

III. Based on area

- Upper third
- Middle third
- Lower third
- Combination

IV. Based on parts of the ear

- Helix
- Antihelix
- Concha
- Scaphoid fossa
- Triangular fossa
- Lobule
- Combination

Principles of reconstruction

The auricle may be divided into zones and the components lost to plan for various methods of repair

Helical rim and lobule

Creates overall appearance of ear.

Mild defects can create largest cosmetic asymmetry

Reconstruction should be planned to give aesthetic results

Care is taken to maintain continuity, height and to prevent step deformity.

Cartilage graft should be planned wherever necessary.

Antihelix and antitragus

This gives support to ear framework. Loss leads to lop ear deformity.

So flaps with cartilage support should be planned.

Cavum concha

Thin does not give support to the ear.

So cartilage support is not needed

It will be enough if skin cover alone is given.

The preauricular and post auricular sulcus should be preserved to give the ear normal projection.

OPTIONS AVAILABLE

Autologous reconstruction

Prosthetic reconstruction

GENERAL TREATMENT PRINCIPLES

Pre-op planning

Template of pinna defect made and defect quantified by comparing with unaffected pinna or with pinna of same age and stature person if both pinna are lost.

Ear is cleaned with povidone iodine solution

Debridement and removal of foreign body wherever necessary has to be done.

Cartilage graft whenever necessary either from conchal or costal cartilage.

Rule of Firmin has to be followed to plan for site of cartilage graft

For <25% defect ipsilateral or contralateral conchal cartilage can be used.

If ≥25% loss of cartilage and biplanar defect is present we have to use costal cartilage graft

Skin cover can be done using surrounding skin, fascia, skin graft or distant or free flaps.

Suction drain should be used wherever necessary

Skin should be sutured using 4-0 or 5-0 polypropylene or ethilon

Mastoid dressing has to be applied to prevent haematoma or seroma formation.

Broad spectrum antibiotics for 5 to 7 days.

Metronidazole to be added if patient had injury due to human bites

Suture removal should be done on 7^{th} to 10^{th} day.

Anaesthesia

Procedures can be carried either under general anesthesia or local anesthesia. Regional anesthesia requires infiltration of local anaesthesia 2% lidocaine with 1:200,000 dilution of epinephrine around greater auricular nerve, auriculotemporal nerve, posterior auricular nerve, and vagus nerve in concha and external auditory canal. Type of anesthesia is decided depending on age, type and duration of procedure.

Reconstructive option

Gille's principles and ladder of reconstruction has to followed. There are various options for ear reconstruction.

1. Primary closure
2. Skin grafts
3. Composite grafts
4. Local and regional flaps
5. Chondrocutaneous flaps
6. Replantation

Primary closure

Simple laceration involving skin only can be closed in a single layer.

In complex laceration involving full thickness layered closure has to be done.

Small skin defects of helical rim can be closed by undermining and advancement.

Small defects of <1.5cm involving helix and antihelix may be amenable to primary closure by converting to wedge excision.

Skin grafts

Skin grafts are useful in skin loss in lateral or medial surface when perichondrium is intact.

Contralateral postauricular skin can be harvested as full thickness skin graft.

Defects between 1.5 – 2 cm involving helix and antihelix can be reconstructed by using composite graft

Local and regional flaps

Local flaps provide good colour and texture match.

Preauricular, postauricular, retromandibular and cervical skin have been used.

Temperoparietal fascial flap provides a well vascularised flap in vicinity for reconstruction

OPTIONS FOR RECONSTRUCTION BASED ON LOCATION

HELICAL DEFECTS

UPPER THIRD DEFECTS

Defects <2cm:

- Antia Buch's chondrocutaneous advancement flap
- Composite grafts

Defects >2cm

- Staged tube flap from postauricular skin-Eave's procedure
- Converse tunnel procedure
- Creckelair banner flap
- Cartilage framework covered with temperoparietal fascia with skin grafting or using local flaps

MIDDLE THIRD DEFECTS

- Composite graft
- Staged tubed flap
- Bipedicle flap
- Antia Buch chondrocutaneous advancement flap
- Converse tunnel procedure
- Diffenbach procedure
- Cartilage graft with temperoparietal fascial flap with skin grafting

Scaphoid fossa and triangular fossa

Defects < 2cm – Primary closure

Defects >2cm – Composite graft

Antihelix Defect

- Composite grafts
- Advancement flaps
- Transposition flaps

Tragus and Helical crus

- Cartilage graft covered with preauricular skin.

Cavum concha

- Local skin flap
- Skin grafts

LOBULE DEFECT

- Preauricular flap
- Post auricular flaps
- Auriculomastoid flap
- Lateral neck skin flap - Zenteno Alanis technique.
- Gavello flap

- Two flap technique of Converse
- Wynn method
- Nelaton and Ombredanne method
- Double cross skin flap of Fadi sleilati

Subtotal or total loss of pinna

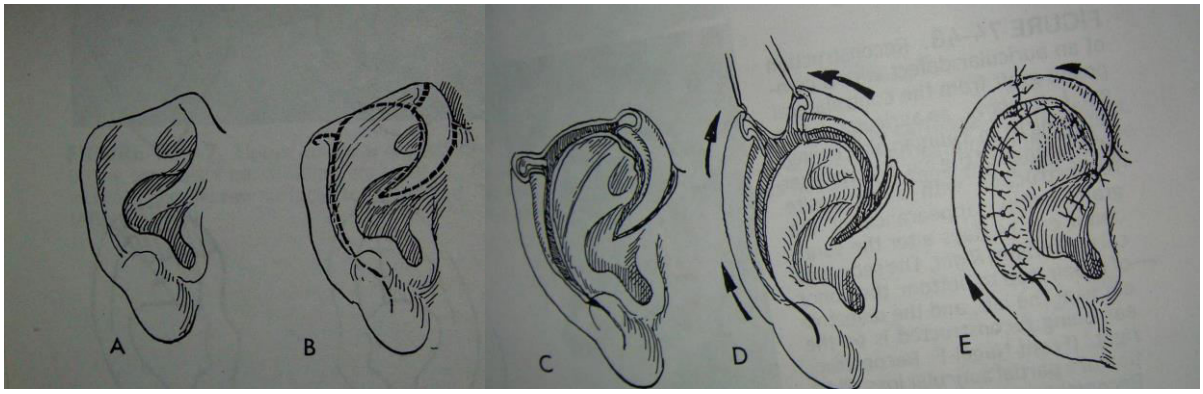
- Replantation
- Staged reconstruction
- Single staged reconstruction using cartilage or alloplastic framework with temperoparietal fascia and skin graft
- Prosthesis implantation

COMPLICATIONS

- Haematoma
- Seroma
- Infection
- Perichondritis
- Flap necrosis
- Keloid formation

SURGICAL TECHNIQUES

Antia Buch's chondrocutaneous advancement



Totally freeing the entire helix from scapha by an incision in helical sulcus that extends through the cartilage but not through the skin on ear's medial surface.

Postero medial auricular skin is undermined dissecting just superficial to perichondrium until entire helix hangs on chondrocutaneous component of loosely mobile skin and it can be mobilised and suturing done.

Extra length can be gained by v-y advancement of crus of helix.

Though initially described for upper third helical defects it is effective for middle third defects also.

Postauricular skin flap

It may be raised inferiorly based, based on posterior auricular artery at the lower auricular pole.

Communication with superficial temporal artery through superior auricular artery is used to raise superiorly based postauricular flap.

Useful in upper, middle-third reconstruction and ear lobule reconstruction.

Bipedicle flap

It is raised in the post auricular mastoid skin

It may be used as tubed flap also.

It is useful in helical rim reconstruction.

It is a staged procedure.

Tubed flap

Cervical skin or post auricular mastoid skin may be used as tube flap.

Fine caliber tubing can be done and it is useful in staged reconstruction of helical rim

Diffenbach technique

In the first stage postauricular flap in advanced and sutured to the anterior layer of defect. Cartilage graft is fixed whenever necessary.

In second stage flap is divided and turned to cover the postero medial aspect of defect.

The donor area is skin grafted.

Disadvantage of this procedure is retroauricular sulcus is not preserved.

Converse tunnel procedure

The auricle is pressed on the mastoid region and the defect is marked.

Incision made along the markings

The anterior edge of mastoid skin is sutured to posterior ear skin flap.

The Posterior edge of mastoid skin is sutured to anterior ear skin flap

Cartilage graft may be fixed if necessary.

In second stage elevation is done after 3 months. Skin graft in applied over the raw area.

Temperoparietal fascial flap (TPFF)

The temperoparietal fascia is the most superficial layer beneath the subcutaneous fat and above the deep temporal fascia in the temporal region and is continuous with the superficial musculoaponeurotic system inferiorly and the galea superiorly. It is supplied by the superficial temporal artery. temperoparietal fascial flap is harvested through an incision extending from the preauricular region either in a lazy S, Y or T fashion from tragus to temperoparietal region. The flap is raised just below the hair follicle but superficial to deep temporal fascia depending upon on the amount of flap required. The flap is raised transposed and sutured to the periphery of cutaneous defect. A skin graft is applied over temperoparietal fascial flap.

Tissue expansion

Placed in mastoid skin pocket through a radial incision in scalp or posterior to the remnant cartilage. Expansion is started after 10 days in weekly increments. Tissue expansion gives local skin of good colour match.

Subtotal and total loss of pinna

Replantation is ideal but complex staged reconstruction based on Brent or Nagata technique as for congenital microtia may be necessary.

Non microsurgical techniques such as composite grafting with or without fenestration of the cartilage may be useful.

When post auricular skin is not available and severely scared. It is ideal to go for temperoparietal fascial flap with skin cover.

Microvascular transfer

Microsurgical replantation is a challenging procedure but allows single staged reconstruction and more naturally appearing pinna.

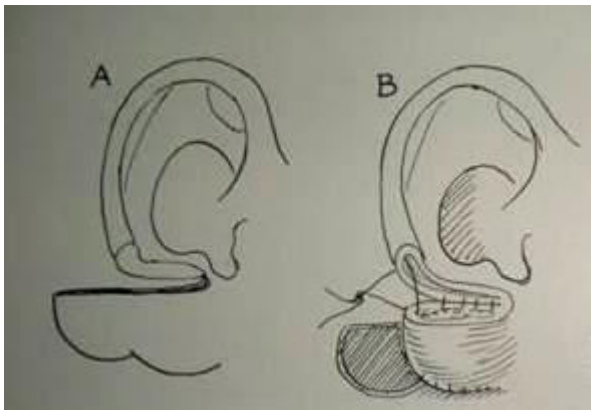
Important prerequisite include short ischaemic intervals, appropriately preserved amputated parts and availability of microvascular facilities. The problems associated were venous congestion for which leech therapy is instituted.

Prelaminated flap by building cartilaginous ear on forearm can be transferred to position of ear as a free flap by microsurgical technique.

Lobule reconstruction

Lobule reconstruction is done using postauricular and preauricular skin, Gavello flap, two flap technique of Converse.

Gavello Method

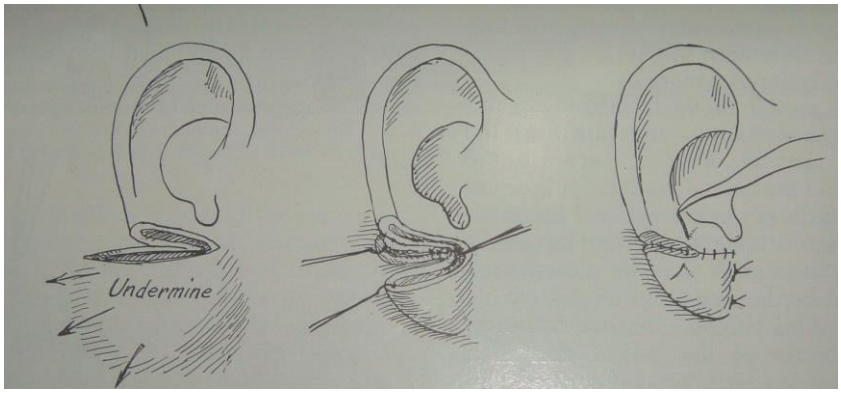


A bilobed flap is outlined based anteriorly. The flap is raised, posterior flap folded under anterior flap and flap sutured to the lobule defect. Donor area is skin grafted.

Ombredanne technique

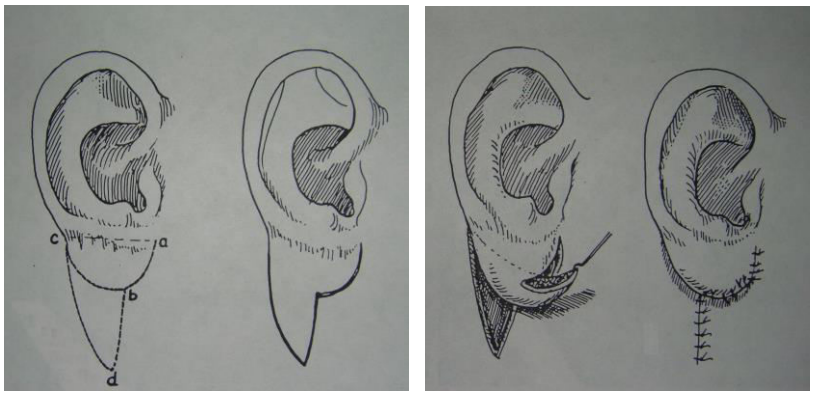
A postero-inferior flap is raised. The superior end is sutured to the lower margin of the lateral surface. Later inferior end of flap is detached, folded under the superior portion of the flap and sutured to medial surface.

Wynn Method



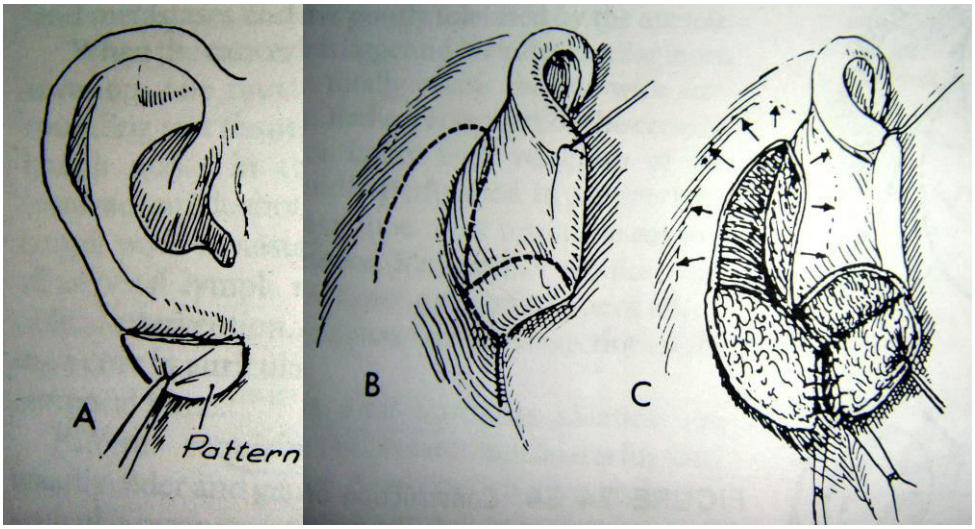
A horizontal incision made in retroauricular region. Extensive undermining of the skin of retroauricular region and neck skin is made. The undermined posterior skin is folded and closed superiorly to lower margin of the ear lobe.

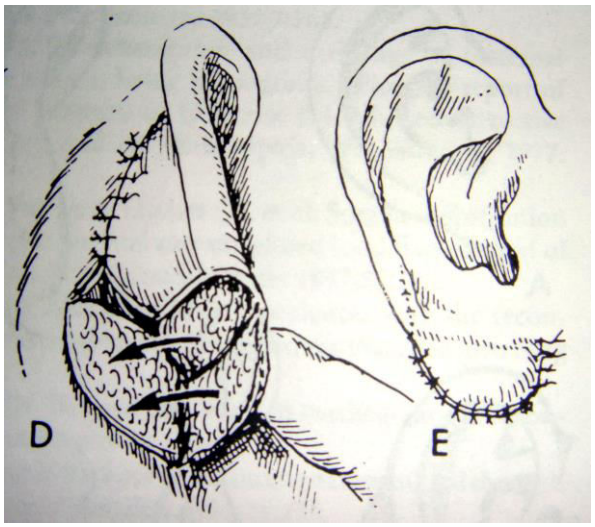
Zenteno Alanis technique



Ear lobe defect is measured from unaffected contralateral auricle. A vertical flap is outlined based on the lateral neck skin. The flap is raised and ear lobe is reconstructed.

Two flap technique of Converse





Flaps to reconstruct the lobule defect is elevated from the posteromedial aspect of the pinna and in retroauricular region. The two flaps are suture to each other to form new lobule.

Double cross skin flap technique

It is a single staged reconstruction based on inferiorly based preauricular skin and superiorly based retromandibular skin. The preauricular skin flap is used to reconstruct the anterior part of the lobule and retromandibular flap folded posteriorly to form the posterior aspect of the ear lobule.

ALLOPLASTIC RECONSTRUCTION

Alloplastic implants made of silicone, MEDPOR are available in various shapes easily sterilisable which can be implanted underneath appropriate soft tissue coverage.

Advantages are easy availability, near normal shape, short operating time, no donor site morbidity.

Disadvantages are infection and extrusion.

AURICULAR PROSTHESIS

External prosthesis can be worn using spectacles.

Prosthesis are indicated where patient refuses surgery and surgical reconstruction is impractical and contraindicated. Disadvantages are they lack warmth, colour change and texture of autogenous reconstruction. There is a constant fear of prosthesis becoming dislodged at embarrassing moments and a psychological discomfort of wearing an artificial part.

Osseointegrated prosthesis

It is done in stages. In the first stage implant is placed in temporal bone or mastoid below the site of antihelix. Implant is covered by cover screw or spacer screw.

In second stage screw is removed and abutment is placed.

In the final stage the prosthesis is attached either by retention clips or magnets.

MATERIALS AND METHOD

The study was conducted in the department of plastic surgery. Government Rajaji Hospital, Madurai Medical College, Madurai during August 2007 to April 2010.

Patients with acquired auricular defects were included in the study. Patients with no tissue loss and managed by primary suturing were not included in this study.

All patients included with acquired defects were due to road traffic accident, assault, human and animal bites, burns, infection and tumour. A total number of 43 cases were included in the study.

All patients were assessed with a thorough history, clinical examination investigations and preoperative planning.

In stable patients primary single staged repair was done or first stage of the staged reconstruction was done on the day of trauma.

In patients with associated injuries they were taken up after proper resuscitation.

Pattern and template were made are per tissue loss.

Procedures outcomes, complications were explained to the patients and informed written consent were obtained for all patients. Cases were followed up after 1 week, and 2 weeks then monthly for atleast 3 months after the final stage of reconstruction.

ANALYSIS

The data obtained were analysed on the following factors.

1. Age and sex of patient
2. Etiology
3. Auricular defects depending on parts of the pinna
4. Single stage or Multiple staged surgery
5. Reconstruction methods
6. Complications

Based on the data obtained, the results of the study were obtained.

RESULTS

AGE

In the forty three patients included in the study the age range was between 14-65 years.

Table I

Sl.No.	Age group	Numbers affected	Percentage
1	0-20	3	7
2	21-40	31	72
3	41-60	8	18.6
4	>60 y	1	2.4
	Total	**43**	**100**

Patients of third and fourth decades formed the major group. They formed about 72%. They are the main active working group.

SEX

Table II

Sl.No.	Sex	Number	%
1	Male	27	63%
2	Female	16	37%
	Total	**43**	**100**

Male patients were affected more than female. The male to female ratio was 1.7:1.

ETIOLOGY

Table III

Sl. No.	Etiology	Number	%
1	Assault	15	35
2	Road traffic accident	14	33
3	Human bite	9	21
4	Burns	5	11
5	Tumours	-	-
6	Others	-	-
	Total	**43**	**100**

In our study the common causes of pinna defects were due to road traffic accidents, assault, human bite and burns. There were no cases of tumour excision in our study.

Assault and human bite were the commonest causes followed by road traffic accident.

SITE OF LESION

Table IV

Sl.No.	Site	Number	Percentage
1	Skin loss only	4	9.3
2	Composite defects		
	- Upper third defect	5	11.63
	- Upper & Middle third	5	11.63
	- Middle third	5	11.63
	- Middle third & lobule	9	20.9
	Lobule only	15	34.85
	Total	**43**	**100**

Lobule loss and lobule with lower third helical defects formed the predominant group of the study forming about 56% of total group. Skin loss alone was present only in 4 patients. Composite loss involving upper and middle third were present in rest of the patients.

SIDE OF LESION

Table v

Sl.No.	Side	Number
1	Right	22
2	Left	21
	Total	**43**

No much difference was found in the side of lesion. They were affected almost equally.

SURGICAL PROCEDURES

Table VI

Sl.No.	Procedure	Number	Percentage
I	Post auricular flap		
	1. Inferiorly based	15	35
	2. Superiorly based	3	7
	3. Bipedicle	3	7
II	Converse tunnel	3	7
III	Diffenbach	2	5
IV	Double cross	9	21
V	Temperoparietal fascia / SSG	4	9
VI	SSG	4	9
	Total	**43**	**100**

Of the various procedures inferiorly based post auricular flap was done in 35% patient followed by double cross skin flap in 21% of patients. The other flaps commonly used were superiorly based post auricular flap, Converse Tunnel, Diffenbach procedures and temperoparietal fascial flaps with skin graft. Skin grafting was done in 4 cases. Cartilage grafting were necessary in 7 cases.

Cartilage graft were harvested from opposite concha in 3 cases and opposite synchondrosis in 4 cases.

STAGES OF RECONSTRUCTION

Table VII

Sl.No.	Stage	Number
1	Multiple	27
2	Single	16
	Total	**43**

Of the various procedures 16 cases were operated in a single stage other cases required more than on stage.

TIMING OF RECONSTRUCTION

Table VIII

Sl.No.	Timing	Number
1	Late	25
2	Immediate (or) 1st Stage of staged reconstruction	18
	Total	**43**

18 cases were taken up immediately either as a single staged procedure or first stage of the staged reconstruction. The burns patients and few patients came late with ear defects for whom late reconstruction were planned. The remaining patients were debrided on the 1st day and planned for reconstruction subsequently.

HOSPITALISATION

Table IX

Sl.No.	Stage	Average No. of Days
1	Single	5
2	Multiple	16

The patients who underwent single stage reconstruction were hospitalised for 3 to 7 days with an average of 5 days, whereas those with staged reconstruction were hospitalised for an average of 16 days.

POST OPERATIVE MANAGEMENT

Patients were started on broad spectrum parentral antibiotics like cefotaxime, ampicillin for 3 days and were converted to oral antibiotics like

cephalosporins or ciprofloxacin. Metronidazole was added if patients were injured by human bites. There were no major infections in our study group. Only one patient developed infection for whom wound swab was taken and started on appropriate antibiotic.

Sutures were removed between 7^{th} and 10^{th} day.

Suction drains were used for Temperoparietal fascial flaps and were removed between 5 to 7 days.

COMPLICATION

Table X

Sl. No.	Complication	Number
1	Wound infection	1
2	Partial graft loss	1
3	Partial flap dehiscence	1
4	Nil	40
	Total	**43**

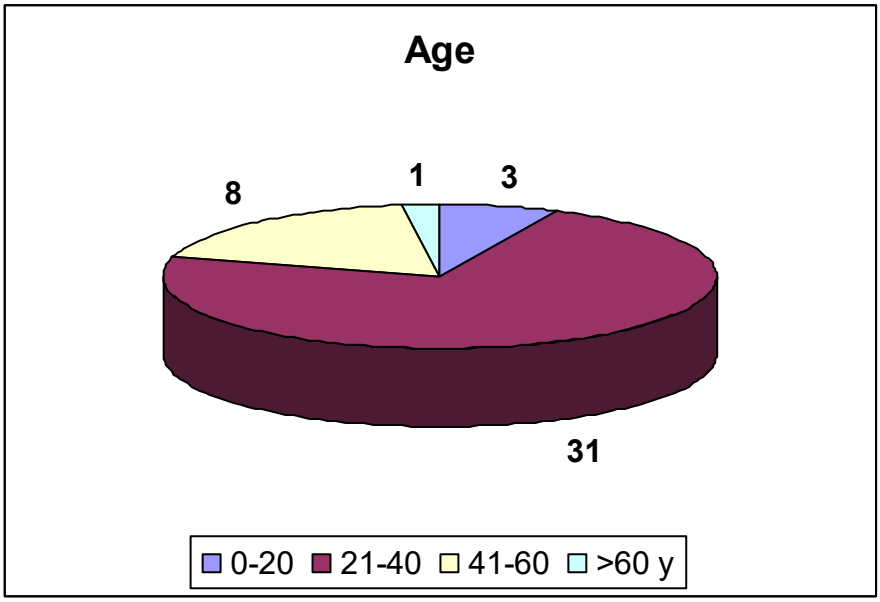
There were no major complication in our study except for wound infection, partial graft loss and partial flap dehiscence in one case each.

DISCUSSION

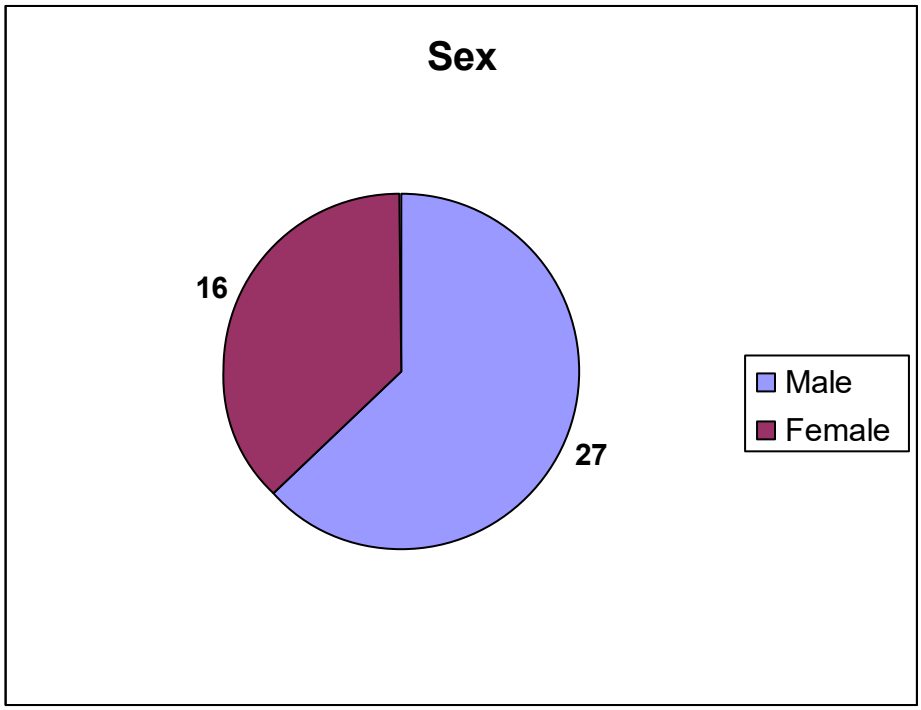
The patients with acquired auricular defects self esteem is affected and have psychological upset. Female patients are very much affected when they are not able to wear ear ring.

Reconstruction of pinna defects are performed to give an aesthetically good appearing pinna at the earliest.

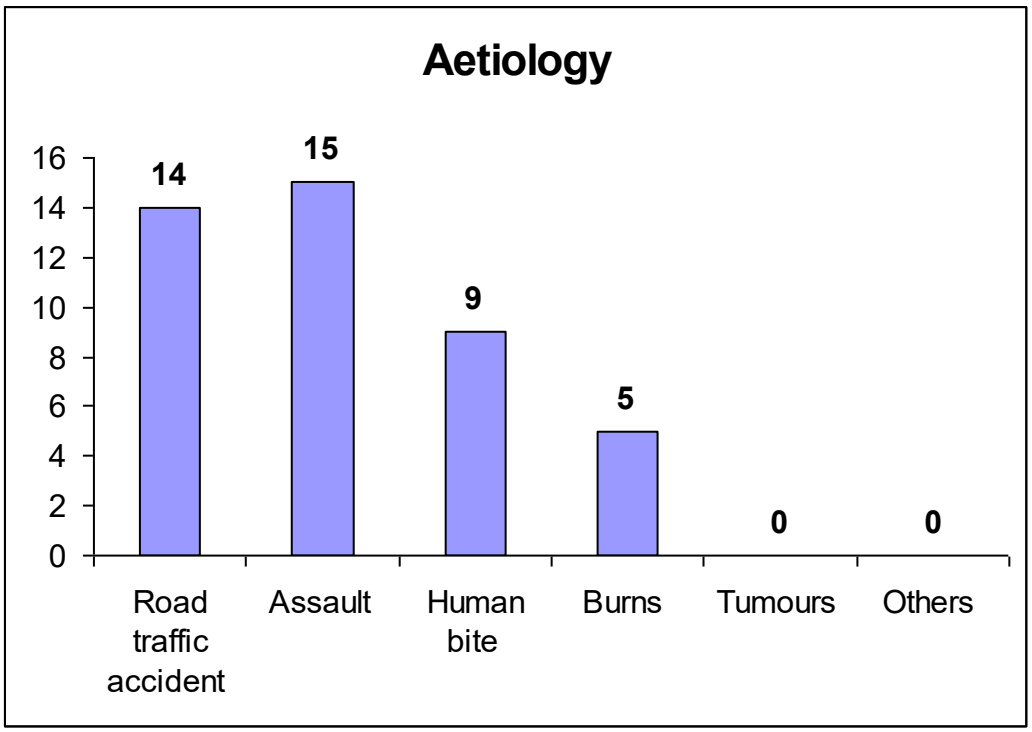
AGE AND SEX



The male patients were commonly affected in about 63%. Age varied from 11-65 years the commonly involved age group were 21-40 years which is the most active and production period of an individual.



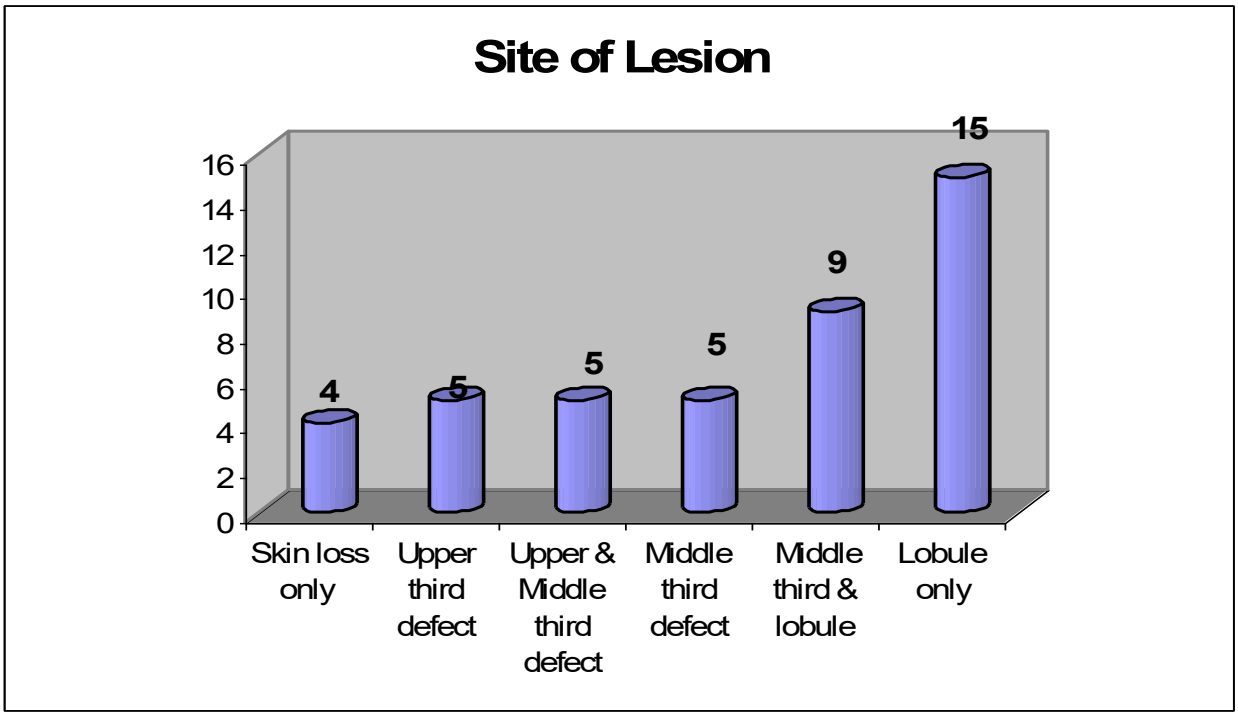
AETIOLOGY



Pinna injuries were commonly involved in road traffic accident and quarrels which led to assault by sharp or blunt instruments and human bites. During assault and human bite there was a preponderance of lobule and middle third pinna. In the female few of the patients involved in quarrel had their ear rings pulled with ear lobule.

There was history of alcohol intake both by victims and assailants in most of the cases. Most of the victims of assault and human bites were school dropouts.

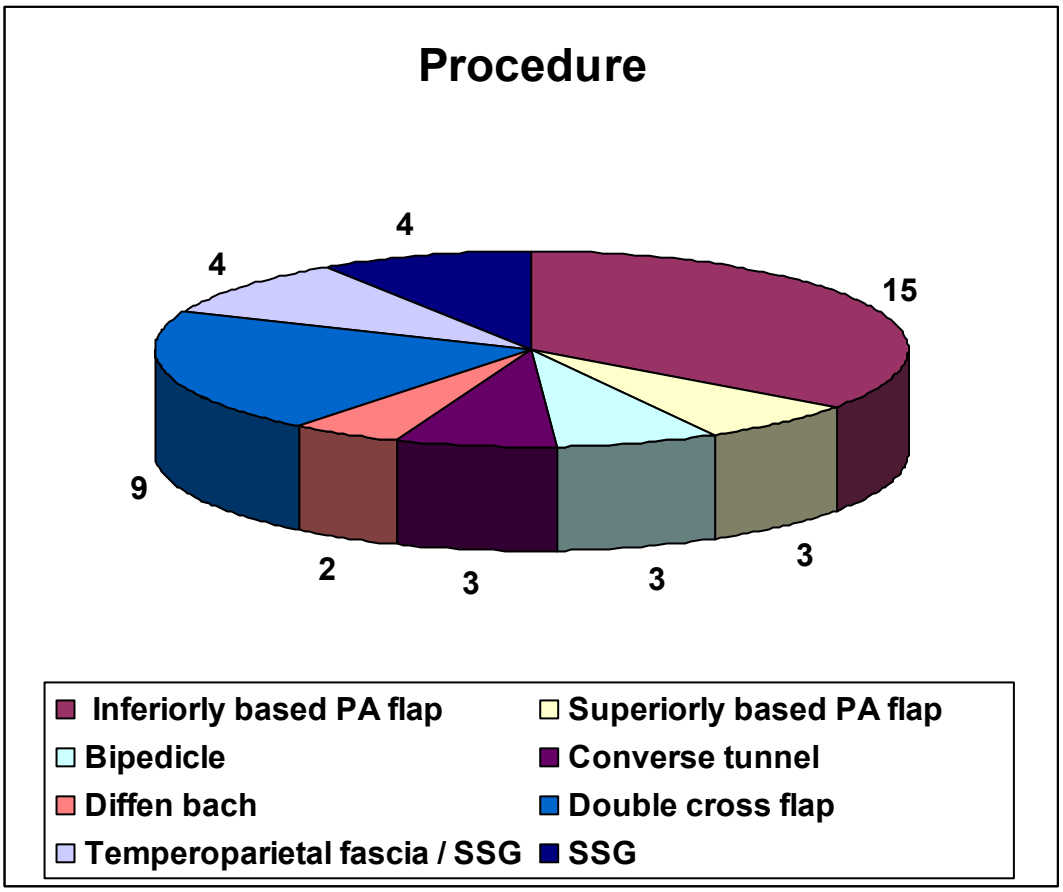
SITE OF LESION



Lobule was the commonest site involved in our study either isolated or with middle 1/3 helical defects taking about 56% of the patients. Composite defects of upper, middle third pinna were equally distributed in about 5 each and combined lesions were present in 5 patients.

The human bite patients and most of the female patients who had assault had loss of the ear lobule. Most of the patients with loss of ear lobule due to human bite and assault were from suburban areas near Madurai.

PROCEDURE



Of the various procedures post auricular flaps and double cross skin flaps were commonly performed.

Inferiorly based post auricular flap or double cross skin flaps were mainly used to reconstruct ear lobule or ear lobule with lower helical defect.

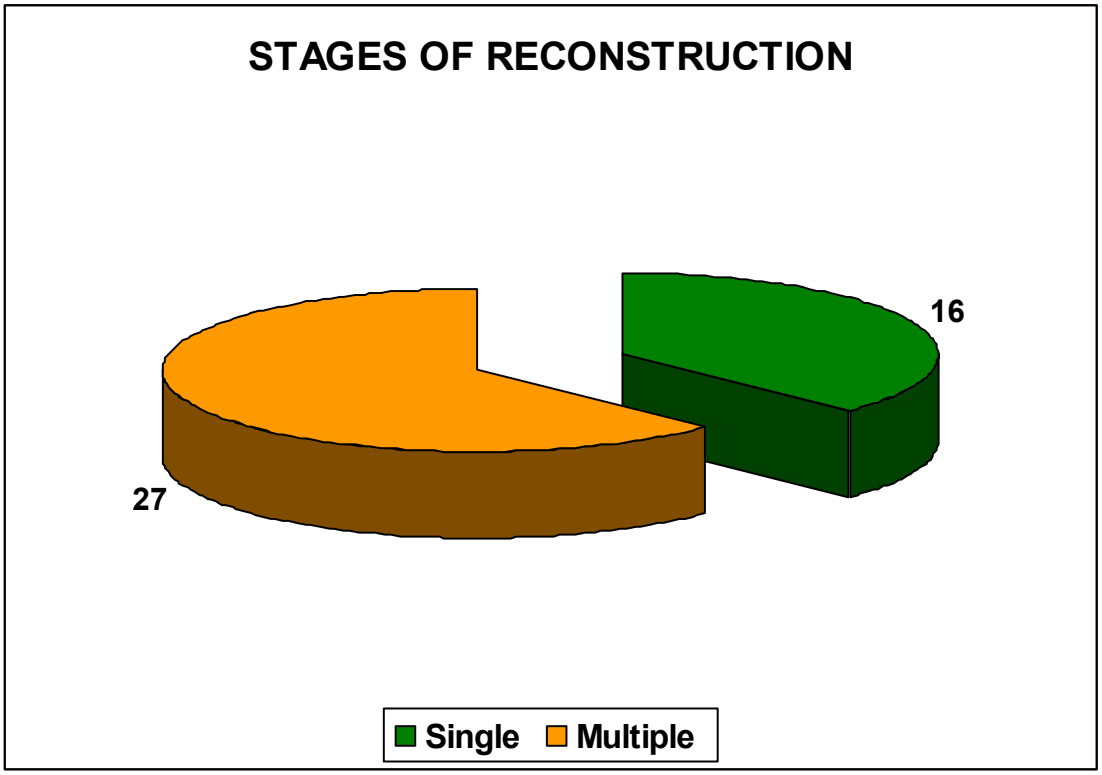
Superiorly based post auricular flap were mainly used for superior third helical defects.

Delay of flaps were done whenever necessary.

Converse tunnel, Diffenbach and Bipedicle flaps were commonly used for middle third defect.

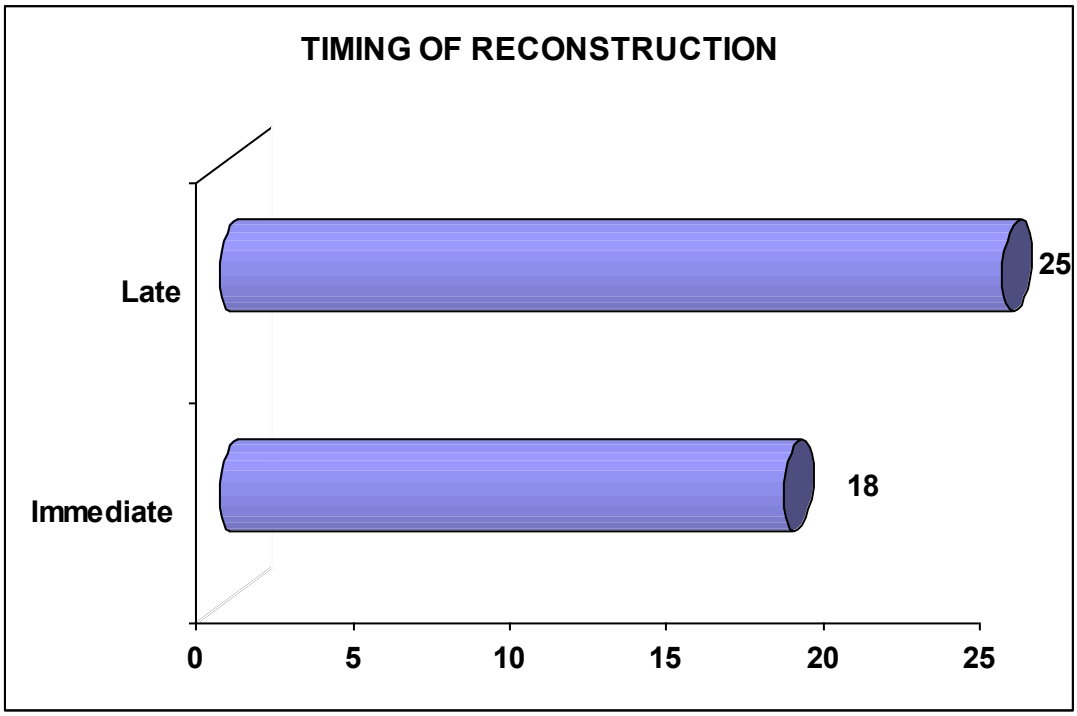
Temperoparietal fascial flap with cartilage framework and skin graft were done for near total pinna loss predominantly in burns patients where the surrounding tissue was scarred and no donor tissue was available for flap cover.

PHASES OF RECONSTRUCTION



Most of the patients underwent single staged surgery or the first stage of the staged reconstruction on the day of admission if patient did not have any other associated major injuries. Patients with other concomitant injuries were

taken up after proper resuscitation. Patients with composite loss and near total loss who needed cartilage support were repaired in a delayed manner and in stages.

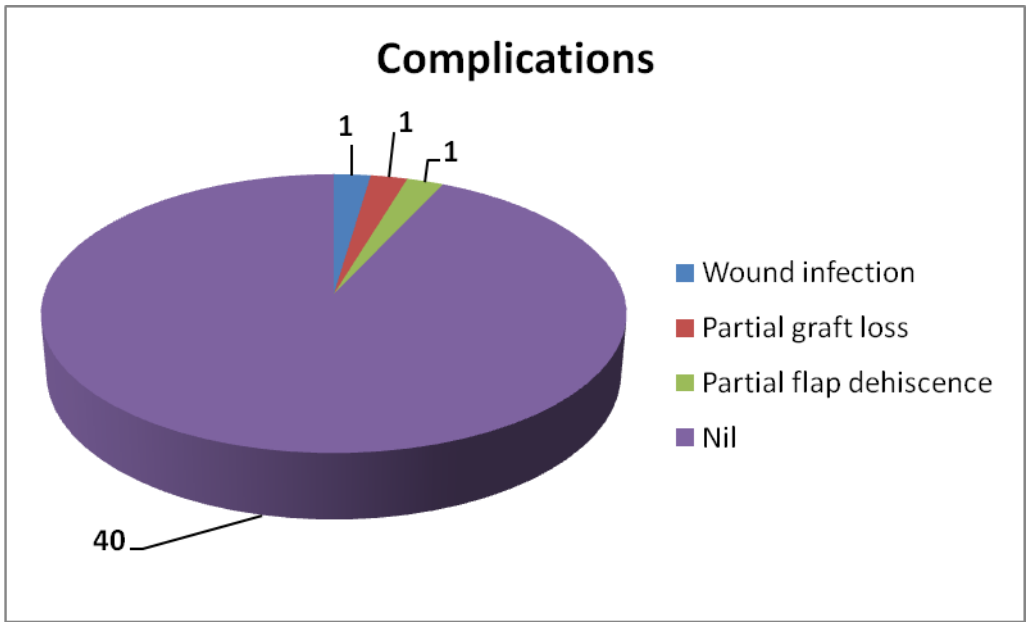


Though initial teaching were against primary reconstruction in case of human bites, we reconstructed them primarily after proper debridement, thorough wash and under antibiotic cover. We never had a major problem in primary reconstruction. In staged reconstruction intervals between the stages varied from 3 weeks to 3 months depending on the types of reconstruction.

The patients who underwent single staged procedures were hospitalised for an average of 5 days and the hospital cost for the patients were less compared to staged reconstruction who had to be hospitalized for an average of 16 days.

Patients who had primary reconstructions done were happy and did not have much psychological trauma of loss of part of pinna.

COMPLICATIONS



The overall complication in our series was less involving only 3 patients. There were no major complications. Infection was present in one case which was treated with appropriate antibiotics. Meticulous debridement and proper antibiotic could have avoided the complication. Partial dehiscence of flap was present in one case which was debrided and reattached. Partial graft loss was present in one case which was managed by regrafting.

CONCLUSION

- Timely coverage of cartilage framework using local flaps prevented perichondritis and deformities.

- For upper third defects superiorly based post auricular flap were ideal.

- For middle third defects Converse tunnel, Diffenbach and bipedicle flaps were done either with or without cartilage graft.

- Double cross skin flap gave good aesthetic results and was very much useful in primary reconstruction of ear lobule in single stage.

- When lobule with helical defect was present staged reconstruction with inferiorly based post auricular flap were ideal.
- For near total loss and scarred skin in adjacent areas as in burns cartilage graft with temperoparietal fascial flap with skin graft were ideal.

- Road traffic accidents were mainly following alcohol intake and driving without helmet. Road safety measures like wearing of helmet and banning drunken driving could decrease the incidence of road traffic accidents.

- Burns injury of ear should be taken care at initial phases itself to prevent earlier complications and late deformities.

- Ear is a major focus for bite injuries. It is difficult how aggression could be managed. Proper education and improving the livelihood, avoiding alcohol intake prevents quarrels and assaults thereby decreasing the incidence of ear injuries.
- Even in human bites and road traffic accidents, proper wound debridement antibiotic coverage, primary repair or first stage of the staged reconstruction could be done.
- **It is ideal to reconstruct the pinna defects primarily so that patient were pleased and their self confidence were greatly boosted.**
- **Prevention is better than cure.**

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PROFORMA

Name :

Age :

Sex :

Address :

IP No. :

DOA :

DOS :

DOD :

Complaints :

Aetiology :

- Assault
- RTA
- Human bite
- Burns
    - Thermal
    - Electrical
    - Chemical
    - Radiation
- Infection

- Tumour

- Others

General Examination

Local Examination

- Helix
- Antihelix
- Lobule-defect
- Concha
- Combination
- Subtotal / total loss
- Avulsion of skin

Diagnosis :

Investigation

Urine routine

Blood investigation

Wound swab – culture & sensitivity

Radiological investigations

Surgery

Postoperative period

Complications

Followup

MASTER CHART

Sl.No.	Name	Age/Sex	IP No.	Injury	Side	Site of Lesion	Procedure	Stage	Complications
1	MADHAN	20/M	56971	Assault	LT	Middle 1/3	Diffenbach procedure	2	Nil
2	MARUTHUPANDI	26/M	59437	RTA	RT	Raw area Pinna Middle 1/3	SSG	1	Nil
3	KARUPPIAH	45/F	808233	Assault	LT	Raw area Pinna upper 1/3	SSG	1	Nil
4	TAMILARASI	45/F	81741	Assault	LT	Lobule defect	Double Cross	1	Nil
5	KALIAMMAL	47/F	95538	RTA	RT	Upper 1/3	TPFF/SSG	1	Nil
6	TAMILARASI	40/F	97541	RTA	LT	Middle third & lobule	Inf. PA Flap	2	Nil
7	PRABHU	28/M	21887	RTA	RT	Upper & Middle 1/3	Converse Tunnel	2	Nil
8	INDIRANI	34/F	50796	RTA	RT	Lobule & Middle 1/3	Inf. PA Flap	3	Nil
9	RAJKAPOOR	25/M	69392	RTA	LT	Lobule	Inf. PA Flap	2	Nil
10	RAJAPATRENGA DURAI	31/M	6510	Assault	LT	Middle 1/3	Diffenbach	2	Nil
11	MALAIRAJ	20/M	3975	Humanbite	RT	Lobule	Double Cross	1	Nil
12	VIJAYA	21/F	4466	ASSAULT	RT	Lobule	Double Cross	1	Nil
13	MOKKAPONNU	50/F	4523	Humanbite	LT	Lobule	Double Cross	1	Nil
14	MANIKANDAN	46/M	29016	RTA	LT	Upper & Middle third	Supr. PA Flap	3	Nil
15	MAHARAJA	23/M	37492	Assault	RT	Lobule	Double Cross	1	Nil
16	SUNDAR	29/M	45798	RTA	RT	Skin Loss Middle 1/3	SSG	2	Minimal Graft Loss
17	THIRUVASAGAM	21/M	58240	Humanbite	RT	Lobule & Middle third	Infr PA Flap	3	Nil
18	SYED IBRAHIM	57/M	72682	Humanbite	RT	Upper 1/3 helix	Supr. PA Flap	2	minimal Flap Dehiscence
19	RAMESH	35/M	87403	Assault	RT	Middle 1/3	Converse Tunnel	2	Nil
20	RAJIV GANDHI	23/M	97878	Humanbite	LT	Upper & Middle third	Converse Tunnel	2	Nil

21	THIRUVEL RAJAN	24/M	99436	Humanbite	LT	Middle Third	Bipedicle flap	4	Nil
22	CHELLAM	65/M	94743	Assault	LT	Middle Third	Bipedicle flap	4	Nil
23	ALAGU	50/F	102994	Humanbite	RT	Lobule	Double Cross	1	Nil
24	MUTHUKUMAR	22/M	6076	RTA	LT	Middle third & lobule	Infr. PA Flap	2	Nil
25	CHITIRAI SELVAM	31/M	72361	RTA	LT	Middle third & lobule	Inft. PA Flap	2	Nil
26	PALPANDI	37/M	74902	RTA	LT	Skin Loss Upper 1/3	SSG	1	Nil
27	LAKSHMANAN	35/M	96269	Assault	LT	Middle third & lobule	Infr. PA Flap	3	Infection
28	THIRUVASAGAM	21/M	98473	Assault	LT	Lobule	Double Cross	1	Nil
29	VENKATACHALAPATHI	30/M	99386	RTA	RT	Lobule	Infr. PA Flap	2	Nil
30	BOSE	28/M	14084	Humanbite	RT	Upper 1/3	Bipedicle	3	Nil
31	SUMATHI	20/F	47055	Assault	RT	lobule defect	Infr. PA Flap	2	Nil
32	ALAGAR	46/M	55776	RTA	RT	Lobule & Middle third	Infr. PA Flap	3	Nil
33	NAGENDRAN	24/M	33013	Humanbite	RT	Lobule	Infr. PA Flap	2	Nil
34	ATHESWARI	16/F	36764	Burns	LT	Upper 1/3	TPFF/SSG	1	Nil
35	MALARKODI	30/F	23996	Assault	RT	Lobule defect	Infr. PA Flap	2	Nil
36	DHANAPACKIAM	33/F	4786	Assault	LT	Lobule defect	Double Cross	1	Nil
37	MUTHUEESWARI	31/F	7540	RTA	LT	Lobule defect	Double Cross	1	Nil
38	PANDIARAJAN	24/F	6296	Burns	LT	Upper & Middle third	TPFF/SSG	1	Nil
39	PANDIAMMAL	35/F	40042	Assault	RT	Lobule & Middle third	Infr. PA Flap	3	Nil
40	VASUKI	21/F	41127	Burns	RT	Lobule & Middle third	Infr. PA Flap	3	Nil
41	NITHYA	11/F	58681	Burns	RT	Upper 1/3	Supr. PA Flap	2	Nil
42	ALAGUDURAI	19/M	64393	Burns	RT	Upper & Middle 1/3	TPFF/SSG	1	Nil
43	DEVI	37/F	68393	Assault	LT	Lobule defect	Infr. PA Flap	2	Nil

Abbrevations

M	Male
F	Female
RTA	Road Traffic Accident
LT	Left
Rt	Right
Infr.	Inferiorly based
supr.	superiorly based
PA	post aricular
TPFF	Temperoparietal fascial flap
SSG	Skin Graft

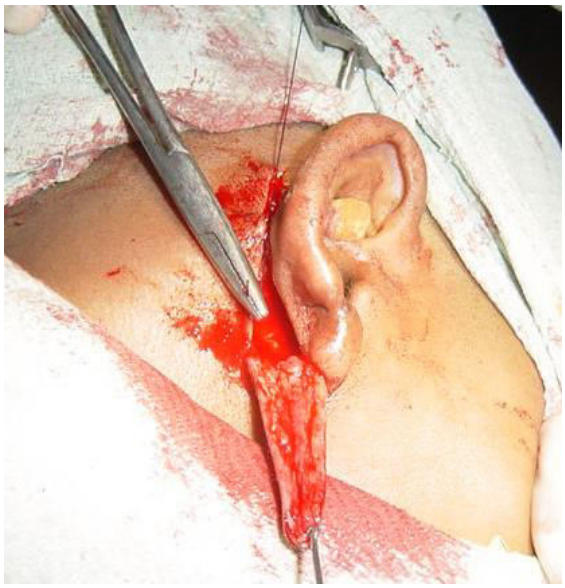
MIDDLE THIRD DEFECT – DIFFENBACH PROCEDURE

MIDDLE THIRD DEFECT – DIFFENBACH PROCEDURE

MIDDLE AND LOWER THIRD DEFECT – BIPEDICLE FLAP

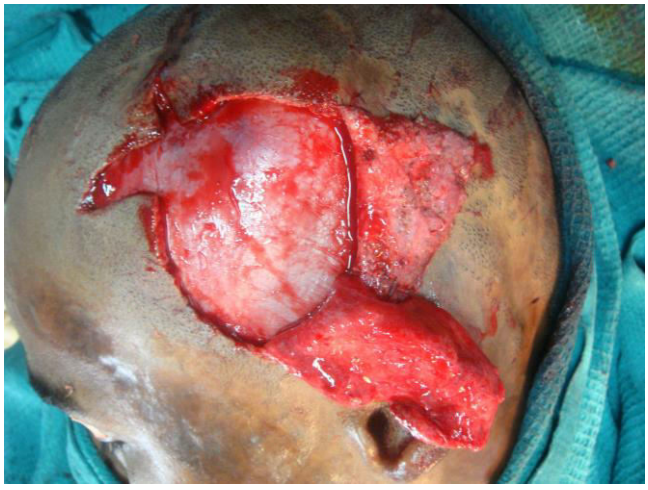
LOBULE DEFECT – DOUBLE CROSS SKIN FLAP

LOBULE DEFECT – INF BASED POST AURICULAR FLAP



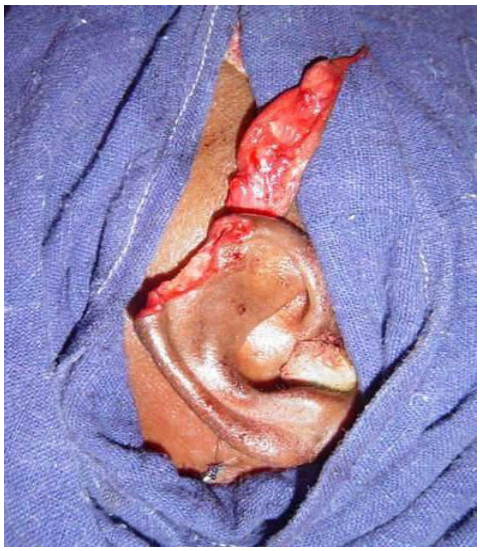
LOBULE DEFECT – DOUBLE CROSS SKIN FLAP

UPPER AND MIDDLE THIRD DEFECT – TEMPEROPARIETAL FASCIA FLAP WITH SKIN GRAFT



MIDDLE & UPPER THIRD DEFECT - CONVERSE TUNNEL PROCEDURE

SUPERIOR THIRD DEFECT – SUPERIORLY BASED POST AURICULAR FLAP



MIDDLE THIRD WITH LOBULE DEFECT - INFERIORLY BASED POST AURICULAR FLAP

LOBULE DEFECT - INFERIORLY BASED

POST AURICULAR FLAP DELAY

SKIN LOSS – SKIN GRAFT

LOBULE DEFECT - INFERIORLY BASED POST AURICULAR FLAP

MIDDLE THIRD WITH LOBULE DEFECT - INFERIORLY BASED POST AURICULAR FLAP

SUPERIOR THIRD DEFECT

TEMPEROPARIETAL FASCIA FLAP WITH SKIN GRAFT